

REMARKS

In view of the above amendments and the following remarks, reconsideration and further examination are respectfully requested.

I. Specification and Abstract

The specification and abstract have been reviewed and revised to improve their English grammar. The amendments to the specification and abstract have been incorporated into a substitute specification and abstract. Attached are two versions of the substitute specification and abstract, a marked-up version showing the revisions, as well as a clean version. No new matter has been added.

II. Drawing Amendments

As mentioned above, proposed drawing amendments are submitted herewith under a separate cover letter.

Specifically, figure 7 has been amended to identify reference element 34 as a “Distributor” rather than a “Distributing.” Further, figure 9 has been amended to identify reference element 45 as a “SW” rather than a “Distributing.” These amendments have been made in order for figures 7 and 9 to remain consistent with the descriptions included in the specification.

These drawing amendments are editorial in nature and do not add new matter to the application.

III. Claim Amendments

Non-elected claims 10-21, 23 and 25 have been cancelled without prejudice or disclaimer of the subject matter contained therein.

Further, independent claims 1, 22 and 24 have been amended to clarify features of the invention recited therein and to further distinguish the present invention from the references relied upon in the rejections discussed below. In addition, new claims 26-35 are presented.

It is also noted that claims 1-9, 22 and 24 have been amended to make a number of editorial revisions thereto. These editorial revisions have been made to place the claims in better U.S. form. Further, these editorial revisions have not been made to narrow the scope of protection of the claims, or to address issues related to patentability, and therefore, these amendments should not be construed as limiting the scope of equivalents of the claimed features offered by the Doctrine of Equivalents.

IV. 35 U.S.C. § 101 Rejection

Claim 24 was rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. Claim 24 has been amended to recite that the program is recorded on a computer-readable recording medium and causes the computer to execute a method. As a result, withdrawal of this rejection is respectfully requested, since amended claim 24 now recites statutory subject matter.

V. 35 U.S.C. § 103(a) Rejections

Claims 1-3, 7-9, 22 and 24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Oda et al. (U.S. 5,204,662), Kawamura et al. (JP 07-131470) and Osakabe et al. (U.S. 5,666,363). Further, claims 4-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Oda and Davies et al. (U.S. 7,360,236). These rejections are believed clearly inapplicable to amended claims 1-9, 22 and 24 and new claims 26-35 for the following reasons.

Amended independent claim 1 recites a signal switching device including (1) a plurality of read-out channels for outputting information (indicating a status of an output destination device) to a plurality of input source devices, each read-out channel of the plurality of read-out channels corresponding to a respective input source device of a plurality of input source devices. Further, claim 1 recites that the signal switching device includes (2) an outputting unit operable to output the information (a) through a read-out channel (of the plurality of read-out channels) that corresponds to an input source device transmitting a video signal selected by a selecting unit (that selects the video signal from a plurality of video signal inputs, each video signal input being transmitted from an input source device of a plurality of input source devices), and (b) to the input source device transmitting the selected video signal. The Oda, Kawamura and Osakabe references fail to disclose or suggest above-mentioned distinguishing features (1) and (2) as recited in independent claim 1.

Initially, please note that the above-described 35 U.S.C. § 103(a) rejection acknowledges that Oda and Kawamura fail to disclose or suggest distinguishing features (1) and (2) (i.e., the

plurality of read-out channels and the outputting unit), as recited in claim 1. In light of the above this rejection relies on Osakabe for teaching the above-mentioned features which are admittedly lacking from Oda and Kawamura.

However, Osakabe merely teaches that a system adds a header to inter-device communications, such that the header includes a device ID/address, operation command data, and automatic status transmission (see Fig. 10).

Thus, in view of the above, it is clear that Osakabe merely teaches using a header including an ID, address, command data, and status information, but fails to disclose or suggest a plurality of read-out channels for outputting information (indicating a status of an output destination device) to a plurality of input source devices, each read-out channel of the plurality of read-out channels corresponding to a respective input source device of a plurality of input source devices, as required by claim 1.

In addition, it is apparent that Osakabe's disclosure of including an ID, address, command data, and status information is not a disclosure or suggestion of an outputting unit operable to output the information (a) through a read-out channel (of the plurality of read-out channels) that corresponds to an input source device transmitting a video signal selected by a selecting unit (that selects the video signal from a plurality of video signal inputs, each video signal input being transmitted from an input source device of a plurality of input source devices), and (b) to the input source device transmitting the selected video signal, as required by claim 1.

In other words, Osakabe fails to disclose or suggest a device that outputs the information to an input source device of a plurality of input source devices through a read-out channel of a plurality of readout channels that corresponds to the input source device that transmitted the

video signal selected by the selecting unit, as required by claim 1.

Therefore, because of the above-mentioned distinctions it is believed clear that claim 1 and claims 2-9 that depend therefrom would not have been obvious or result from any combination of Oda, Kawamura and Osakabe.

Furthermore, there is no disclosure or suggestion in Oda, Kawamura and/or Osakabe or elsewhere in the prior art of record which would have caused a person of ordinary skill in the art to modify Oda, Kawamura and/or Osakabe to obtain the invention of independent claim 1.

Accordingly, it is respectfully submitted that independent claim 1 and claims 2-9 that depend therefrom are clearly allowable over the prior art of record.

Regarding dependent claims 4-6, which were rejected under 35 U.S.C. § 103(a) as being unpatentable over Oda in view of Davies, it is respectfully submitted that Davies does not disclose or suggest the above-discussed features of independent claim 1 which are lacking from the Oda, Kawamura and Osakabe, as discussed above. Therefore, no obvious combination of Oda and Davies would result in, or otherwise render obvious, the invention recited independent claim 1 and claims 2-9 that depend therefrom.

Amended independent claims 22 and 24 are directed to a method and a program, respectively and each recite features that correspond to the above-mentioned distinguishing features of independent claim 1. Thus, for the same reasons discussed above, it is respectfully submitted that claims 22 and 24 are allowable over any combination of Oda, Kawamura, Osakabe and/or Davies.

Now turning to new claim 26 and claims 27-35 that depend therefrom, claim 26 recites a signal switching device including (1) a plurality of control signal transmission lines for

transmitting a device control signal between an output destination device that is an output destination of a video signal and a plurality of input source devices. Further, claim 26 recites that the signal switching device includes (2) a selecting unit operable to select the video signal of a plurality of video input signals transmitted from a plurality of input source devices, the video signal being selected according to the device control signal transmitted, via the plurality of control signal transmission lines, from the input source device that received information indicating a status of the output destination device. The above-mentioned Oda, Kawamura, Osakabe, and Davies references fail to disclose or suggest above-mentioned distinguishing features (1) and (2), as recited in independent claim 26.

Rather, Oda merely teaches selecting any one of a plurality of video signal inputs (see figs. 4(a) and 4(b)). Thus, it is clear that Oda fails to disclose or suggest transmitting a device control signal between an output destination device that is an output destination of a video signal and a plurality of input source devices, and fails to disclose or suggest the video signal being selected according to the device control signal transmitted, via the plurality of control signal transmission lines, from the input source device that received information indicating a status of the output destination device, as required by claim 26.

In other words, Ode only teaches selecting a video signal input, but fails to disclose or suggest selecting the video signal according to the device control signal, as recited in claim 26.

Therefore, because of the above-mentioned distinctions it is believed clear that claim 26 and claims 27-35 that depend therefrom would not have been obvious or result from any combination of Oda, Kawamura, Osakabe and/or Davies.

Furthermore, there is no disclosure or suggestion in Oda, Kawamura, Osakabe and/or

Davies or elsewhere in the prior art of record which would have caused a person of ordinary skill in the art to modify Oda, Kawamura, Osakabe and/or Davies to obtain the invention of independent claim 26. Accordingly, it is respectfully submitted that independent claim 26 and claims 27-35 that depend therefrom are clearly allowable over the prior art of record.

VI. Conclusion

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance and an early notification thereof is earnestly requested. The Examiner is invited to contact the undersigned by telephone to resolve any remaining issues.

Respectfully submitted,

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DESCRIPTION

SIGNAL SWITCHING DEVICE, SIGNAL DISTRIBUTION DEVICE,
DISPLAY DEVICE AND SIGNAL TRANSMISSION SYSTEM

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Technical Field

The present invention relates to a signal switching device for
switching a plurality of inputting signals, a signal distribution device
for outputting the inputted signal to a plurality of devices, a display
10 device for displaying video, and a signal transmission system.

Background Art

~~In recent years, in~~ In view of recent popularity of digital
technology for digital video and communication satellite
15 broadcasting, a system connecting digital devices using such a
digital technology on a same network, and controlling the digital
devices has been building up.

As one of a digital interface, Digital Visual Interface (DVI) is
available. This interface includes a high speed signal transmission
line which enables ~~to transmit transmission of~~ a digital video signal
without compressing the signal, an Extended Display Identification
Data (EDID) memory which holds information such as signal format
being shown in the device at receiving side to provide to an
upstream (signal source side), and a Display Data Channel (DDC) for
25 reading out the information (for example referring to "Digital Visual
Interface DVI, revision 1.0", 2.2 Plug and Play specification, [online],
April 2, 1999, Digital Display Working Group, [searched on August
29, 2002], ~~the internet URL:~~ <http://www.ddwg.org/downloads.html>).
Furthermore the DVI includes a Hot Plug Detect (HPD) line for giving
30 a notice of the state that the information recorded in the EDID
memory being readable, and the change of the content. The HPD
line enables ~~to output outputting of~~ the information indicating the

change of the content, only in the case where power is supplied from the device in upstream to a device with an HPD line.

A case is considered that a control line for controlling the connected device for the interface (DVI) is added. As an example,
5 a case is considered that a control line used for a SCART connector (CENELEC, EN 50049-1:1997/A1:1998) used in Europe is added.

Disclosure of Invention

The control line composes a bus connected between an input
10 and an output of all devices including a DVI. On the control line, a logical address, which is the information to define respective devices on a network set up by DVI, is defined. The logical address is determined as "STBb" and the like by making adjustment between the respective device types (DVD recorder/player, Set Top Box (STB),
15 TV and so on) and the same type of devices. And then the address is held in the device including a DVI added control line.

In the header of a message transmitted through the control line, the logical address of a message sender and the logical address of a message receiver are included. The message includes a
20 broadcast message in which the device including the DVI added all control lines is the receiver. The device including the DVI, in which the respective control lines ~~being~~are added, judges whether or not the broadcast message is the message to be processed by comparing the own logical address and the receiver in the header.

25 As mentioned above, by adding a control line to the DVI, an interface connecting a display device such as a TV and a recorder/player such as DVD recorder/player by a single cable can be realized.

However, only by combining the DVI and the control line, a
30 certain device is unable to control another device. Especially in a system including a signal switching and distribution device such as switch and duplicator, a user desires that a certain device

configuring the system is able to control another device. However, such a function has not been realized. It is not specified whether or not the device is under a controllable state, for example in different states such as the power of respective devices is on or off and the information stored in the EDID memory is readable or not.

Furthermore, it is specified that one route device exists in device control, and only one logical address to "TV" is specified. However, it is not specified about an operation of the certain device in a case where not less than two TVs (route devices) are connected to a certain device by failure or intentionally, and about a method to prevent from malfunctioning of the certain device.

Accordingly, only by combining the DVI and the control line, a certain device is unable to control another device connected to the certain device.

In view of above problem, an object of the present invention is to provide a signal switching device, a signal distribution device, and a display device, which include an interface having a video signal communicating unit, a DDC and an HPD, that control the connected devices, and are controlled by connected devices.

In order to solve the problem mentioned above and to achieve the purpose mentioned above, the signal switching device of the present invention includes: a selecting unit for selecting any one of a plurality of video signal inputs; a memory for storing information; a reading channel for reading the information out of an output destination device which is an output destination of a video signal; a reading unit for reading the information indicating a physical address of the signal switching device and a status of the output destination device through the reading channel; a storing unit for storing the information read by the reading unit into the memory; a read-out unit for reading out the information stored in the memory; a plurality of read-out channels for outputting the information to a plurality of input source devices which is an input source of a

plurality of video signal inputs; and an outputting unit for outputting the information indicating the status of the output destination device through the read-out channel.

The signal distribution device of the present invention
5 includes: a distributing unit for outputting a video signal to a part of or all of a plurality of output destination devices which are output destinations of a plurality of video signals; a memory for storing information; a plurality of reading channels for reading the information out of the plurality of output destination devices; a
10 reading unit for reading the information indicating a physical address of the signal distribution device and a status of the output destination device through the reading channel; a storing unit for storing the information read by the reading unit into the memory; a read-out unit for reading out the information stored in the memory;
15 a read-out channel for outputting the information to an input source device which is an input source of video signal; and an outputting unit for outputting the information indicating the status of output destination device through the read-out channel.

A display device of the present invention includes: a selecting unit for selecting any one of a plurality of videos; a display unit for displaying the video selected by the selecting unit; a memory for storing information indicating a physical address of an input source device which is an input source of video signal and a status of the display device; a read-out unit for reading out the information stored in the memory; a read-out channel for outputting the information to the input source device; and an outputting unit for outputting the information indicating the status of the display device through the read-out channel.
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Accordingly, the signal switching device, the signal distribution device and the display device of the present invention include the memory and the read-out channel. In the respective memories, physical addresses of the respective devices, information
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indicating the status of device to be connected, and information indicating the status of the devices are stored, it is, therefore, possible to control the connected device, or to be controlled by the connected device.

5 Additionally, a signal transmission system of the present invention includes: a video signal transmission device; a video signal processing device; and a video signal receiving device. The video signal processing device has: a memory for storing information, a reading channel for reading the information from the
10 video signal receiving device, a reading unit for reading the information indicating a physical address of the video signal processing device and a status of the video signal receiving device, a storing unit for storing the information read by the reading unit into the memory, a read-out unit for reading out the information stored in the memory, a read-out channel for outputting the information to the video signal transmission device, and an outputting unit for outputting the information indicating a status of
15 the video signal receiving device through the read-out channel.

Accordingly the video signal processing device of the signal
20 transmission system of the present invention includes the memory and the read-out channel, and the physical address of the video signal processing device and the information indicating the status of the video signal receiving device are stored into the memory. Therefore the video signal transmission device, the video signal processing device and the video signal receiving device are able to
25 control or to be controlled mutually in the signal transmission system of the present invention.

In other words, according to the present invention, it is possible to control the device that transmits an uncompressed video
30 signal by adding a control line to the DVI.

Also a switch and a duplicator and the like using the DVI can be realized.

Additionally, in the case where not less than two of TVs are connected through the switch, the duplicator and the like, there is an effect that it is possible to control the connected devices within the area divided by the switch and the duplicator.

5 Furthermore the components which are characteristics of the signal switching device or the signal distribution device of the present invention, can be realized as steps of methods, and also as a program including these steps. The program can be distributed through recording media such as a CD-ROM and a transmission
10 media such as a communication network.

Description of Drawings

FIG. 1 is a block diagram showing a configuration of a signal transmission system including a switcher 2 of a first embodiment
15 and a second embodiment.

FIG. 2 is a drawing showing a configuration of switcher 2 of the first embodiment and the second embodiment.

FIG. 3 is a drawing showing a configuration of TV 1 of the first embodiment and the second embodiment.

20 FIG. 4 is a sequence drawing describing each procedure of an operation for the signal transmission system of the first embodiment.

FIG. 5 is a sequence drawing describing each procedure of an operation for the signal transmission system of the second
25 embodiment.

FIG. 6 is a block diagram showing a configuration of the signal transmission system including a distribution device 10 of a third embodiment.

FIG. 7 is a drawing showing a configuration of distribution
30 device 10 of the third embodiment.

FIG. 8A is a drawing showing a format of a video signal that
the TV 1 is able to receive.

FIG. 8B is a drawing showing a format of the video signal that the TV 11 is able to receive.

FIG. 9 is a drawing showing a configuration of a distributor.

5 **Best Mode for Carrying Out Detailed Description of the Invention**

~~Hereinafter, the best mode for carrying out the present invention is described referring to drawings.~~

(First embodiment)

10 First, a configuration of a signal transmission system of the first embodiment is described using FIG. 1 to FIG. 3.

FIG. 1 is a block diagram showing a configuration of a signal transmission system of the first embodiment. As shown in FIG. 1, the signal transmission system of the first embodiment includes a TV 1, a switcher 2, a recorder a3, a DVD a4, a STB a5 and a STB a6. The switcher 2 and the recorder a3 are connected to TV 1, the DVD a4 and the STB a5 are connected to the switcher 2, and the STB b6 is connected to the recorder a3.

20 The TV 1 is a display device. The switcher 2 is a device for selecting either a video signal from the DVD a4 or a video signal from the STB a5. The recorder a3 is a device for recording a video signal from the STB b6. The DVD a4 is a device for reproducing the video signal recorded inon a DVD. The STB a5 and the STB b6 are devices for receiving a video signal and outputting the video signal.

25 In FIG. 1, the notations are shown in each block indicating the TV 1, the switcher 2, the recorder a3, the DVD a4, the STB a5 and the STB a6 respectively. The notations represent the physical addresses of the devices indicated by the blocks with the notations.

30 The physical address is information ~~to specify specifying~~ how the devices are connected each other (actually how control lines are connected). The physical address is held in the predetermined position of the EDID memory set up in the device at a receiver side,

and is read out through the DDC at the time of start-up. Here the devices at the receiver side are the TV 1 for the TV 1 and the switcher 2, and the switcher 2 for the switcher 2 and the DVD a4. The device (for example the switcher 2) with the added DVI added 5 the control line generates physical addresses of the respective sub-devices (device connected to input side directly) from the own physical address, and holds the physical address with the own logical address.

The display device such as the TV is unable to read out the 10 own physical address out of the device downstream, since the display device is a device at the final arriving point of the signal (route device). Therefore, when the power is turned on, the route device sets up a physical address, for example (0000) for itself and holds the address. In the case where two devices are connected to 15 route device directly, the physical addresses of respective devices are determined as (1000) and (2000). In the case where three devices are connected to the device whose address is (1000), the physical addresses of respective devices are determined as (1100), (1200) and (1300) sequentially.

20 FIG. 1 shows a situation that the physical address of the TV 1 being a route device is (0000), and the physical addresses of the switcher 2 and the recorder a3 connected to the TV 1 directly are (1000) and (2000) respectively. And also FIG. 1 shows a situation that the DVD a4 and the STB a5 whose physical addresses being 25 (1100) and (1200) respectively are connected directly to the switcher 2 whose physical address being (1000).

FIG. 2 is a drawing showing a configuration of the switcher 2 with two inputs and one output.

As shown in FIG. 2, the switcher 2 includes a video input unit 30 20a configuring the DVI at a first video input side (hereafter called as "the first input DVI"), a control line (CTL) 21a, a DDC 22a and a HPD 23a. And also the switcher 2 includes a video input unit 20b

configuring the DVI at a second video input side (hereafter called as "the second input DVI"), a control line (CTL) 21b, a DDC 22b and a HPD 23b. The switcher 2 includes a video output unit 24c configuring the DVI at video output side, a control line (CTL) 25c, a 5 DDC 26c and a HPD 27c.

Additionally, the switcher 2 includes a switch (SW) 30, an EDID memory 32 and a microcomputer 33.

The switch 30 selects either the video input unit 20a or the video input unit 20b. The EDID memory 32 is a memory for holding 10 ~~such as information, such as information~~ indicating a status of the TV 1. The information indicating the status of the TV 1 is for example information indicating a format of video signal that the TV 1 is able to receive. And also as information indicating the status of TV 1, information related to products (type number, serial number, 15 manufacturer and ~~manufactured—manufacture~~ date year/month/date), information related to video format (pixel, gamma, color information such as R, G, and B), and information related to timing (number of samples, frame rate) are available. The EDID memory 32 also holds at least a physical address of the 20 video input unit (the video input unit 20a or the video input unit 20 b) selected by the switch 30. The microcomputer 33 manages the status of switcher 2 based on the information being held in the EDID memory 32, and controls the switch 30, the control line 21a, the control line 21b and the control line 25c.

25 Here the DDC 22a and the DDC 22b are examples of read-out channels, and the DDC 26c is an example of a reading channel. The control line 21a, the control line 21b and the control line 25c are examples of control signal transmission line. A reading unit, a storage unit, a read-out unit, an output unit, a voltage detecting unit, 30 a power status control unit, a power supply unit and an address setup unit are included in the microcomputer 33.

FIG. 3 is a drawing showing a configuration of the TV 1 with

two inputs.

As shown in FIG. 3, the TV 1 includes a first input DVI and a second input DVI like the switcher 2. In other words, The TV 1 includes the video input unit 20a, the control line (CTL) 21a, the 5 DDC 22a, and the HPD23a, and also the video input unit 20b, the control line (CTL) 21b, the DDC 22b and the HPD 23b. The TV 1 also includes a switch (SW) 41, an EDID memory 42, a microcomputer 43 and a screen-~~44~~⁴⁰. In FIG. 3, the same notations are used for the same components with the components shown in FIG. 2 and the 10 explanation is not included.

The switch 41 selects either the video input unit 20a or the video input unit 20b. The EDID memory 42 is a memory for holding, for example the information indicating a status of the TV 1. The EDID memory 42 also holds at least the physical address of the 15 video input unit (the video input unit 20a or the video input unit 20b) selected by the switch 41. The microcomputer 43 manages the status of the TV 1 based on the information being held in the EDID memory 42, and controls the switch 41. The screen ~~44~~⁴⁰ displays videos based on video signal from the video input unit (the video 20 input unit 20a or the video input unit 20b) selected by the switch 41.

Next an operation of signal transmission system of the first embodiment is described.

It should be noted that in the following description, the operations of the TV 1, the switcher 2 and the DVD a4 are described 25 using FIG. 4 to explain the operation of the switcher 2 in detail.

FIG. 4 is a sequence drawing to describe each procedure of an operation for the signal transmission system of the first embodiment.

First, suppose a status that the powers of all devices are off. 30 In other words, suppose that powers of the TV 1, the switcher 2, the recorder a3, the DVD a4, the STB a5 and the STB b6 are off. Under this status, a user turns on the power of the DVD a4, and presses a

PLAY button.

In this case, the DVD a4 starts reproduction (S1). Additionally the DVD a4 pulls up a control line and power is supplied to the switcher 2 through a power supply line (not illustrated), and 5 supplies power with +5 voltages (S2). The DVDa4 also attempts to obtain the own physical address which is supposed to be held in the EDID memory 32 to the switcher 2 (S3). However as the power of devices other than the DVDa4 are not on yet, the DVD a4 is unable to obtain the own physical address from the device (the switcher 2) 10 downstream yet. The DVD a4, therefore, keeps reading the own physical address through the DDC 22a until the DVD a4 gets the own physical address.

The DVD a4 sends a message <Image View On> through the control line 21a to the TV 1 (S4). The DVD a4 sets up the own 15 logical address into the parameter of the message sender, and sets up the logical address of the TV 1 into the parameter of the receiver. The control line 21a, the control line 21b and the control line 25c of the switcher 2 are connected each other, so that the message from the DVD a4 can be reached to the TV 1 as far as a device pulling up 20 a control line is available (S4).

In the TV 1, the microcomputer 43 receives the message <Image View On> through the control line 21a, and then turns on the power of the TV 1 (S5), so that the video can be shown.

In the switcher 2, the microcomputer 33 detects a pull-up of 25 the control line, and then turns on the power of the switcher 2 (S6). Alternatively the microcomputer 33 may turn on the power of the switcher 2 when a message is on the control line (S6).

Next the microcomputer 33 of the switcher 2 supplies power with +5 voltages to the TV 1 (S7). In the TV 1, the microcomputer 30 43 detects that power with +5 voltages is supplied to the TV 1, and then outputs the information indicating the supply of power (responding to power supply) through the HPD23a (S8). The

physical address of the TV 1 (0000) and the physical addresses of the sub-devices (1000) and (2000) are set up in the EDID memory 42 of the TV 1.

In the switcher 2, the microcomputer 33 detects that the information indicating that the power with +5 voltage being supplied to the TV 1 (responding to power supply) is outputted from HPD 23a of TV 1, and then reads the physical address of the switcher 2 (1000) out of the TV 1 through the DDC26c, and then sets up the address in the EDID memory 32 (S9). At the same time, the microcomputer 33 reads out ~~also~~ the format of a_video signal that the TV 1 is able to receive, and then registers the format in the EDID memory 32. The format of the video signal includes a_resolution and a_frequency of the video signal that the TV 1 is able to receive. It should be noted that in the case where the switcher 2 reads out the physical address of the switcher 2 and the format of a~~the~~ video signal that the TV 1 is able to receive from the TV 1, the microcomputer 43 of the TV 1 reads out the above-mentioned physical address and format from the EDID memory 42 and outputs to the switcher 2 through the DDC 22a.

The microcomputer 33 also sets up the physical addresses of the sub-devices of the switcher 2 (1100) and (1200) into the EDID memory 32 (S10). Further the microcomputer 33 outputs the information indicating a change of the content of the information held in the EDID memory 32 from the HPD 23a (S11).

In the case where the DVD a4 detects that the information indicating a change of the content of the information held in the EDID memory 32 of the switcher 2, the physical address of the DVD a4 (1100) is read out of the switcher 2 through the DDC 22a, and then sets up in its own memory (S12). At the same time, the DVD a4 reads out the format of video signal that the TV 1 receives from the switcher 2, and sets up the format in its own memory (S12). The DVD a4 reflects the format set up in the memory in setting up of

video signal to be outputted. It should be noted that at the time that the DVD a4 reads out the physical address of the DVD a4 and the format of video signal that the TV 1 is able to receive from the switcher 2, the microcomputer 33 of the switcher 2 reads the 5 above-mentioned physical address and the format out of the EDID memory 32, and outputs the address and the format to the DVD a4 through the DDC 22a.

The DVD a4 broadcasts a message <active source> through the control line 21a (S13). The message includes the physical 10 address of the DVD a4 (1100). In the TV 1, the microcomputer 43 receives a message <active source> from the control line 21a, and then changes the internal connection to the DVD a4 side (S14). In other words, the microcomputer 43 has control of the switch 30 to select the video input unit 20a (S14).

In the switcher 2, the microcomputer 33 receives the 15 message <active source> from the control line 21a, and then compares the physical address (1100) in the message and the physical address of the switcher 2 (1000) set up in the EDID memory 32. At this time, the microcomputer 33 watches the second digit 20 (hundreds place) from the beginning of the two physical addresses, and then changes the internal connection to the DVD a4 side (S15). In other words the microcomputer 33 controls the switch 30 so that 25 the switch 30 selects the video input unit 20a (S15). Accordingly the microcomputer 33 is able to perform the control specified by the message properly by using the message and the physical address specified by the message.

In this way, the video signal line from the DVD a4 to the TV 1 is built up, the TV 1 receives a video signal from the DVD a4 and then shows the video based on the video signal.

30 In the above-mentioned first embodiment, a user turns on the DVD a4 and presses the PLAY button, so that the DVD a4 sends the message <Image View On> to the switcher 2 and the TV 1.

Accordingly the power of the switcher 2 and the TV 1 are turned on without user's operation. Afterward the DVD a4 sends the message <active source> to the switcher 2 and the TV 1. Accordingly the respective switches of the switcher 2 and the TV 1 select the DVD a4 side without user's operation. As a result, the user turns on the DVD a4 and presses the PLAY button, so that the video signal line from the DVD a4 to the TV 1 are built up.

Thus the device, which sends out a message through a control line, pulls up the control line, as a result it is possible for the device to put the other device in a status that a message can be received automatically, and also to put in a status that the EDID is readable and to turn on the power.

In fact in the first embodiment, by using a message and a physical address specified by the message, the control specified by the message can be performed properly.

It should be noted that in the first embodiment, in the case where the DVD a4 pulls up a control line and supplies the switcher 2 with power through a power supply line, power of the switcher 2 is turned on. On the contrary, in the case where the voltage of a control line is decreased to ground voltage, the power of the switcher 2 may be off.

Besides, in the above-mentioned first embodiment, the microcomputer 33 of the switcher 2 receives the message <Image View On> from the DVD a4, and then supplies power to the TV 1. Alternatively the microcomputer 33 receives other messages from the DVD a4, and then may supply power to the TV 1. Additionally in the case where the control line 21a, the control line 21b or the control line 25c are not used, the microcomputer 33 may stop supplying power to the control line 21a, the control line 21b and the control line 25c. Accordingly the microcomputer 33 controls the power supply to all of or part of the control line 21a, the control line 21b and the control line 25c depending on whether or not the control

line 21a, the control line 21b and the control line 25c are used.
(Second embodiment)

In this embodiment, it is described that the control performed
in the first embodiment is performed from the TV 1 side ~~using~~
5 according to FIG. 5. The configuration of the signal transmission
system of the second embodiment is the same as the configuration
of the signal transmission system of the first embodiment.

FIG. 5 is a sequence drawing to describe each procedure of an
operation for the signal transmission system of the second
10 embodiment.

Suppose that from a state that power of all devices are off,
the user turns on the power of the TV 1. The TV 1 is a route device,
and the own physical address (0000) and the physical addresses of
15 the sub-devices (1000) and (2000) are set up in the EDID memory
42 in advance. The user changes the input by operation using a
GUI or a remote controller of the TV 1, and selects the DVD a4.

The TV 1 pulls up a control line, and sends a message <Power
ON> to the DVD a4 through the control line 21a and the control line
21b (S21). The TV 1 sets up the own logical address into a
20 parameter of the message sender, and also the logical address of the
DVD a4 into a parameter of the message receiver.

The DVD a4 detects the message <Power ON>, and then the
power is turned on (S22). Since the physical address of other
devices might have been changed ~~during while~~ the power of the TV
25 1 is off, the TV 1 confirms the physical address of the DVD a4 using
a message <Give Physical Address> (S23). In fact the TV 1
broadcasts the message <Give Physical Address> (S23).

In the switcher 2, the microcomputer 33 detects a pull up of a
control line, and then turns on the power of the switcher 2 (S24).
30 Alternatively the microcomputer 33 may turn on the power of the
switcher 2 when the message is on the control line. In the switcher
2, the microcomputer 33 turns on the power, and supplies power

with +5 voltages voltage to the TV 1 (S25). In the TV 1, the microcomputer 43 detects power supply of +5-voltages voltage, and then outputs the information (responding to power supply) indicating the change of the content of the TV 1 from the HPD 23a
5 (S26).

In the switcher 2, the microcomputer 33 detects that the information (responding to power supply) indicating the change of the content of the TV 1 from the HPD 23a is outputted, and then reads the physical address of the switcher 2 (1000) out of the TV 1
10 through the DDC 22a (S27). Additionally the microcomputer 33 reads out a format of a video signal that the TV 1 is able to receive (S27). The microcomputer 33 sets up the read-out physical address of the switcher 2 (1000) into the EDID memory 32 (S28). The microcomputer 33 also sets up the physical addresses of the
15 sub-devices (1100) and (1200) into the EDID memory 32 (S28). Further the microcomputer 33 sets up a format of a video signal that the TV 1 is able to receive into the EDID memory 32 (S28). The microcomputer 33 outputs the information indicating the change of the information set up in the EDID memory 32 out of the HPD 23a
20 and the HPD 23b (S29).

The DVD a4 reads the own physical address (1100) out of the switcher 2 through the DDC 22a, and sets up in a memory equipped in the DVD a4 (S30). The DVD a4 responds to the message <Give Physical Address> from the TV 1 using a message <Report Physical
25 Address> (S31). The DVD a4 sets up the own logical address in a parameter of the message sender, and sets up the logical address of the TV 1 in a parameter of a receiver.

In the TV 1, the microcomputer 43 changes the switch 41 so that the switch 41 selects the DVD a4 side (S32), and then broadcasts a message <Set Stream Path> from the control line 21a
30 and the control line 21b (S33). In the switcher 2, the microcomputer 33 receives a message <Set Stream Path> from a

control line, and then changes the switch 30 to DVD a4 side (S34). As a result the video signal line from the DVD a4 to the TV 1 is built up.

In the TV 1, the microcomputer 43 sends a message <PlayCommand> to the DVD a4 through a control line (S35). The DVD a4 starts reproduction according to the format of the video signal received by the TV 1 (S36). The TV 1 receives the signal from the DVD a4 and displays.

As described hereinbefore, a user operates the TV 1 so that the TV 1 selects the DVD a4, thus the TV 1 pulls up a control line, and then sends the message <Power ON> to the DVD a4. As a result the powers of the switcher 2 and the DVD a4 are turned on without user's operation. Afterward the TV 1 broadcasts a message <Set Stream Path>. In the switcher 2, the microcomputer 33 changes the switch 30 to the DVD a4 side based on the message. As a result the video signal line from the DVD a4 to the TV 1 is built up without user's operation of the switcher 2 and the DVD a4.

In fact, as the first embodiment, the device, which sends out a message through a control line, pulls up the control line, as a result it is possible for the device to put the other device in a status that a -message can be received automatically, and also to put in a status that the EDID is readable and to turn on the power. And also by using a message and a physical address specified by the message, the control (building up a signal line here) specified by the message can be performed properly.

On the contrary, in the case where the powers of both the DV 1 and the DVD a4 are off, the status is changed to indicate that a message is not sent to a control line, thereby the device which pulls up the control line is not available. The microcomputer 33 of the switcher 2 detects that the control line 21a and the control line 21b are returned to GND level, and turns off power of the switcher 2. Accordingly, in the case where power of all devices other than

specified device are turned off, an application which turns off the power of specified device can be realized.

(Third embodiment)

Next, the signal transmission system of the third embodiment
5 is described using FIG. 6 to FIG.8.

FIG. 6 is a block diagram showing a configuration of the signal transmission system of the third embodiment. As shown in FIG. 6 the signal transmission system of the third embodiment includes the TV 1, a TV 11, a switcher 12, a distribution device 10, the DVD a4, 10 the STB a5, a recorder b7, and the STB b6. The DVD a4, the STB a5 and the recorder b7 are connected to the switcher 12, a video based on a signal selected by the switcher 12 is shown on the TV 1. And also the signal outputted from the STB b6 ~~are~~is sent to the TV 1 and the TV 11 by the distribution device 10.

15 In FIG. 6, the same notations are used for the same components with the components shown in FIG. 1 and the explanation is not included. The TV 11 is a display device. The switcher 12 is the same type of device as the switcher 2. The distribution device 10 is a device for outputting signal from the STB 20 b6 to ~~either or both of~~and/or the TV 1 ~~or~~and/or the TV 11. The recorder b7 is the same type of device as the recorder a3.

In FIG. 6, the notations indicating each device are shown in each block. The notations represent physical addresses of the devices indicated by the blocks with notations.

25 FIG. 7 is a drawing showing a configuration of the distribution device 10 with one input and two outputs. In FIG. 7, the same notations are used for the same components with the components shown in FIG. 2 and the explanation is not included. In FIG. 7, a distributor 34 distributes a video signal from the video input unit 20a to ~~two of the a~~a video output unit 24c and a video output unit 24d, a switch 31 changes the control line (CTL) 25c and a control line (CTL) 25d which are control signal transmission lines. One of the 30

two outputs for the DVI includes the video output unit 24d, the control line 25d, a DDC 26d which is a reading channel and a HPD 27d.

As shown in FIG. 6, in the case where the distribution device 5 10 is available, it is possible to connect plurality of devices including both the TV 1 and the TV 11. However under the rule of a control line in the SCART, only one device having a logical address of a TV on a bus is allowed to exist. Further there is no rule to indicate for either the TV 1 or the TV 11, that the physical address of the 10 distribution device 10 is obtainable. In a case where the physical address is obtained from both the TV 1 and the TV 11, different values are obtained incompatibly, or the physical addresses of the distribution device 10 and devices upstream are changed at every control, as a result a problem that proper control cannot be 15 performed is caused.

As a countermeasure, the distribution device 10 is equipped with the switch 31 for internal connection of the control line, which receives control from the microcomputer 33, and selects either the TV 1 or the TV 11. In this way, the control line is connected to 20 either one of the TVs at one time, and this can prevent from not conforming to a logical address rule. Further, the microcomputer 33 regulates not to read a physical address from the DDC at not-selecting side. For example when the microcomputer 33 of the distribution device 10 selects the TV 11, the switch 31 connects the 25 control line 25d and the control line 21a, and the control line 25c and the control line 21a are not connected. And also the microcomputer 33 reads the physical address of the distribution device 10 out only of the DDC 26d, and not to read out of the DDC 26c. And then the microcomputer 33 sets up the physical address 30 of the distribution device 10 read out of the DDC 26d into the EDID memory 32. As a result, incompatibility on the physical address can be prevented.

Besides, as the first embodiment, in the distribution device 10, the microcomputer 33 detects a pull-up of the control line, and then turns on the power of the device. Alternatively the microcomputer 33 may turn on the power of the device when a message is sent.

5 Thus, by pulling up a control line, the distribution device 10 is put in a status that a message can be received automatically, or put in a status that EDID is readable.

Further, the microcomputer 33 of the distribution device 10 detects that the control line 21a, the control line 25c and the control

10 line 25d returned to GND level, and then turns off the power of the device. Accordingly, in the case where the power of all devices other than specified device are turned off, an application which turns off the power of specified device can be realized. The transmission of a physical address and the response to a message are the same as

15 the first embodiment and the second embodiment.

As shown in FIG. 6, in the case where the distribution device 10 selects the TV 11 side, that is the video outputting unit 24d side, the TV 1 (physical address = 0000), the switcher 12 (1000), the distribution device 10 (2000), the DVD a4 (1100), the STB a5 (1200), the recorder b7 (1300) and the STB b6 (2100) are connected to a bus. The TV 11 is able to receive and to reproduce a signal, but is not able to control other devices by sending a message, and ~~no~~is not able to make signal source side adjust the format by offering a video format to which TV 11 ~~being~~is able to correspond.

On the other hand, in a different case from the case shown in FIG. 6, in the case where the input change of the TV 1 selects the switcher 12 side, that being the video input unit 20a side, and also the distribution device 10 selects the TV 11 side, that being the

30 video output side 24d, the TV 1 (0000), the switcher 12 (1000), the DVD a4 (1100), the STB a5 (1200) and the recorder b7 (1300) are connected to the first bus. Further the TV 11 (0000), the

distribution device 10 (1000) and the STB b6 (2100) are connected to the second bus. In this case, the TV 1 and the TV 11 can be route devices individually, and it is possible to send and receive a message and to make signal source side adjust the format.

5 Here, suppose that a case where plurality of formats of video signals that the TV 1 being able to receive, and plurality of formats of video signals that the TV 11 being able to receive are available. FIG. 8A shows a format of video signals that the TV 1 ~~being-is~~ able to receive and FIG. 8B shows a format of video signals which the TV
10 11 ~~being-is~~ able to receive. As shown in FIG. 8A, the format of the video signals that the TV 1 ~~being-is~~ able to receive are four, (a1) to (a4). On the contrary as shown in FIG. 8B, the format of the video signals that the TV 11 ~~being-is~~ able to receive are three, (b1) to (b3). The format shown in (a2) and the format shown in (b1) are common.
15 On this account, the microcomputer 33 of the distribution device 10 sends a message to the STB b6 to output video signal with the common format shown in (a2) and (b1). According to the message, the STB b6 outputs video signal with the format shown in (a2) and (b1). Accordingly, the TV 1 and the TV 11 are able to receive the
20 video signal from the STB b6.

It should be noted that in the case where there are plurality of formats of the video signal that the TV 1 ~~being-is~~ able to receive and also the TV 11 ~~being-is~~ able to receive, the microcomputer 33 of the distribution device 10 may send a message indicating that plurality of formats exist to the STB b6. The STB b6 selects either one of the plurality of formats. At this time, setting rules such as selecting video signal with the highest resolution, and then the STB b6 may select either one out of plurality of formats based on the rule.
25

Besides, the distribution device 10 may be replaced by a distributor 101 equipped with a switch 45 for executing internal connection of video output as shown in FIG. 9. In this case according to the selection by the microcomputer 33, changing of the
30

video signal by the switch 45 and changing of the control line by the switch 31 are interlocked, it is, therefore, possible to control for the device which selects and distributes a video signal.

It should be noted that in each embodiment, all of or part of
5 the functions of each component or all of or part of each step
explained above can be realized using a recording medium for
storing program to be executed by a computer.

Furthermore, in the above-mentioned embodiment, the signal
switching device of the present invention is exemplified using the
10 switcher 2 with two inputs and one output, and the signal
distribution device of the present invention is exemplified using the
distribution device 10 with one input and two outputs. However,
the present invention is not limited to these examples, the signal
switching device and the signal distribution device of the present
15 invention may have not less than two inputs and outputs.

Further in the above-mentioned embodiments, in the signal
transmission system of the present invention, the DVD a4 and the
STB a6 are used as examples of a video signal transmission device.
And also as examples of video signal processing device, the switcher
20 2 and the distribution device 10 are used, while as an example of a
video signal receiving device, the TV 1 and the TV 11 are used.

Industrial Applicability

A signal switching device, a signal distribution device and a
25 display device of the present invention are practical as devices
controlling device connected through an interface of DVI and so on
having a video signal communicating unit, a DDC and an HPD.

ABSTRACT

A signal switching device including an interface having a video signal communicating unit, a DDC and an HPD, controlling connected device, or being controlled by connected device. A switcher (2) includes a switch (30) for selecting video signal input, a DDC (26c) for reading information from output destination device, a microcomputer (33) for reading information indicating a physical address of switcher (2) and a status of the output destination device through DDC (26c), and a DDC (22a) and a DDC (22b) for outputting information to a plurality of input source devices. The microcomputer (33) stores the physical address of the switcher (2) and above-mentioned information into an EDID memory (32) and reads the above-mentioned information out of the EDID memory (32) and outputs through the DDC (22a) and the DDC (22b).